

NOTES for LLNL List of Controlled Carcinogens for Nonlaboratories

1. The most common name is used first, than synonyms.
2. This is an incomplete list of materials that can penetrate through the skin and exert harmful effects at other locations. Only materials acknowledged as being hazardous in this manner by the American Conference of Governmental Industrial Hygienists (ACGIH) are listed. Many other compounds are probably also hazardous in this manner.
3. Any substance contacting the skin can potentially harm the skin.
4. Key:
 - .1003—One of a set of carcinogens regulated by OSHA in the early 1970s for which no Occupational Exposure Limit (OEL) was developed. These are now addressed by a regulation for carcinogens, 29 CFR 1910.1003. There is almost invariably a hyphen in the adjacent OSHA PEL column and to the left in the TLV column which implies that exposures shall be minimized or eliminated.
 - .1xyz—A material covered by an OSHA substance specific regulation, 29 CFR 1910.1xyz. The OEL will be listed in the next column.
 - 1926.1000—The OSHA regulation for asbestos in the construction industry which includes common building/plumbing work.
 - No listing, but an OEL is listed in the next column—OSHA has an air contamination limit for it in their general guidance for air contaminants, 29 CFR 1910.1000.
5. Could be formed by strongly heating ABS polymer.
6. Employee personal breathing zone air sampling *required* by the cited OSHA standard.
7. See "Safe Handling of Asbestos-Containing Material during Construction Work" (H&SM S21.19) in Volume II of the *ES&H Manual* for guidance.
8. Soots and tars have been known carcinogens since 1775 when scrotal cancer was identified among chimney sweeps as an occupational disease. The carcinogenicity rating bodies are now addressing these mixtures. NTP rated 15 polycyclic aromatic hydrocarbons (PAHs) as Reasonably Anticipated carcinogens. PAHs are present in the tars left after the destructive distillation (anaerobic heating) of coal to produce coke in coke ovens. This is why OSHA regulates exposures to coal tars in 29 CFR 1910.1029. Exposures to tars and soots, defined as the products of incomplete

combustion or the products of strong anaerobic heating processes similar to the destructive distillation of coal, such as coal gassification, shall be reviewed by the area ES&H Team. Air and surface samples may be needed as part of the evaluation. These samples can be analyzed by chemical and/or biological (Ames/*Salmonella* assay) means.

9. See "Safe Handling of Beryllium and Its Compounds" (H&SM S21.10) in Volume II of the *ES&H Manual*. Beryllium is the subject of special controls according to 10 CFR 850.
10. Highly soluble compounds like calcium chromate are not considered to be as carcinogenic as more insoluble compounds such as zinc chromate or strontium chromate.
11. The OSHA regulation is based on avoiding known reproductive effects.
12. See "Safe Handling of Lead and Lead Compounds in General Industry and Construction Operations" (H&SM S21.20) in Volume II of the *ES&H Manual* for guidance. The OSHA standard is based on avoiding a host of adverse effects, some known for centuries. Inorganic lead compounds used in laboratories are covered by Section 5 of "Safe Handling of Carcinogenic Materials" (H&SM S21.16) in Volume II of the *ES&H Manual*.
13. Found in some two-component adhesives.
14. The non-PAH ingredients are addressed by a TLV of 5 mg/m³, but it is proposed to address the PAHs with a TLV of 5 µg/m³.
15. Not rated as a carcinogen due to insufficient evidence. This listing is included for information.
16. These are in widespread specialty use as insulators for furnaces and other special applications. Control of exposures from maintenance actions or other uses which could create airborne fibers with these shall be addressed by at least a Hazard Analysis and Control form (HAC). The application usually precludes using wet methods during fabrication, although wet methods can be used for clean up. Vacuum cleaners shall have HEPA filters. The manufacturers of these products recommend handling them as though they were carcinogenic.
17. Listed for comparison purposes only since it is not rated as a carcinogen.
18. Applies only to irritatingly strong concentrations.
19. Could be formed by strongly heating PVC polymer.

20. The following materials were not listed here, even though they are listed by the National Toxicology program and/or the International Agency for Research on Cancer, because they are pharmaceuticals: 1,4-Butanediol dimethanesulfonate (Busulphan; Myleran) (CAS No. 55-98-1), Chlorambucil (CAS No. 305-03-3), Ciclosporin (CAS No. 79217-60-0), Diethylstilbestrol (DES) (CAS No. 56-53-1), Estradiol-17b (Unconjugated estrogens) (CAS No. 50-28-2), Estrone, (CAS No. 53-16-7), Ethinylestradiol (Unconjugated estrogens) (CAS No. 57-63-6), Melphalan (CAS No. 148-82-3), Methoxsalen with Ultraviolet A Therapy (PUVA) (methoxsalen not carcinogenic alone (CAS No. 484-20-8), MOPP and other combined chemotherapy including alkylating agents, Tamoxifen (CAS No. 10540-29-1), Thiotepa (tris(1-aziridiny)phosphine sulfide) (CAS No. 52-24-4), Treosulfan (CAS No. 299-75-2). In addition smokeless tobacco and tobacco smoke were also not listed.

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Compound ¹	CAS Number	^{2, 3} Skin Hazard	OSHA-regulated carcinogens ⁴
2-Acetylaminofluorene	53-96-3		.1003
Acrylonitrile ⁵	107-13-1	X	.1045 ⁶
Aflatoxins	6795-23-9		
4-Aminodiphenyl	92-67-1		.1003
Arsenic, inorganic	7440-38-2 (metal)		.1018 ⁶
Asbestos ⁷			.1001, 29 CFR 1926. 1000
Benzene	71-43-2	X	.1028 ⁶
Benzidine (and salts)	92-87-5 for benzidine	X	.1003
Benzo(a)anthracene ⁸	56-55-3		.1029
Benzo(a)pyrene ⁸	50-32-8		"
Benzo[b]fluoranthene ⁸	205-99-2		"
Benzo[j and k]fluoranthene ⁸	205-82-3 and 207-08-9, respectively		"
Benzotrichloride (see alpha-chlorinated toluenes entry)	98-07-7	X	
Beryllium and compounds ⁹	7440-41-7 (metal)		
N,N-Bis(2-chloroethyl)-2-naphthylamine (Chlornaphazine)	494-03-1		
1,3-Butadiene ⁶	106-99-0		.1051 ⁶
Cadmium	7440-43-9 metal		.1027 ⁶
1-(2-Chloroethyl)-3-(4-methylcyclohexyl)-1-nitrosourea (MeCCNU)	13909-09-6		
Chloroform	67-66-3		
bis(Chloromethyl) ether	542-88-1		.1003
Chloromethyl methyl ether	107-30-2		.1003
Chromium (VI) compounds ¹⁰			
Water soluble (not otherwise specified)	Varies		
Insoluble compounds	Varies		
Coal gassification ⁸			
Coal dust (anthracite or bituminous)			
Coal tars and coal tar pitches			

Compound ¹	CAS Number	^{2,3} Skin Hazard?	OSHA-regulated carcinogens ⁴
Coal tar pitch volatiles ⁸	65996-93-2		.1029
Cyclophosphamide	50-18-0		
Creosotes	8001-58-9		
Diazomethane	384-88-3		
Dibenz[a,h]acridine ⁸	226-36-8		.1029
Dibenz[a,j]acridine ⁸	224-42-0		"
Dibenz[a,h] anthracene ⁸	53-70-3		"
Dibenzo[a,e] pyrene ⁸	192-65-4		"
Dibenzo[a,h] pyrene ⁸	189-64-0		"
Dibenzo[a,i] pyrene ⁸	189-55-9		"
Dibenzo[a,l] pyrene ⁸	191-30-0		"
7H-Dibenzo[c,g] carbazole ⁸	194-59-2		"
1,2-Dibromo-3-chloropropane (DBCP) ¹¹	96-12-8		.1044 (for reproductive effects) ⁶
3,3'-Dichlorobenzidine	91-94-1	X	.1003 includes its salts
1,4-Dichloro-2-butene	764-41-0		
Diesel exhaust particulate ⁸			
Dimethyl carbamoyl chloride	79-44-7		
4-Dimethylaminoazobenzene (xyloidine)	60-11-7	X	.1003
Dimethyl sulfate	77-78-1	X	
Erionite	66733-21-9		
Ethyleneimine (aziridine)	151-56-4	X	.1003
Ethylene oxide	75-21-8		.1047 ⁶
Formaldehyde	50-00-0		.1048 ⁶
Indeno[1,2,3-cd]pyrene	193-39-5		.1029
Lead and inorganic lead compounds ¹²			.1025 ⁶
4,4-Methylenebis(2-chloroaniline) (MBOCA, MOCA)	101-14-4	X	
Methyl chloromethyl ether	107-30-2		.1003
5-Methyl chrysene ⁸	3697-24-3		.1029
4,4-Methylenedianiline ¹³	101-77-9	X	.1050 ⁶
Mineral oils ^{8,14}	8007-45-2		
Mustard gas (Sulfur mustard)	505-60-2		
1-Naphthylamine	134-32-7		.1003

Compound ¹	CAS Number	^{2,3} Skin Hazard?	OSHA-regulated carcinogens ⁴
2-Naphthylamine	91-59-8		.1003
Nickel			
Nickel, metallic	7440-02-0		
Nickel, insoluble compounds			
Nickel, soluble compounds ¹⁵			
Nickel subsulfide	12035-72-2		
4-Nitrobiphenyl	92-93-3	X	.1003
N-Nitrosodimethylamine (dimethylnitrosamine; DMN)	62-75-9	X	.1003
Oil mist (The 15 PAHs listed by NTP and listed here are measured) ^{8,15}			
beta-Propiolactone	57-57-8		.1003
Refractory ceramic fibers (Saffil, Fiberfrax, etc., etc.) ¹⁶			
See also synthetic vitreous fibers			
Silica, respirable			
Cristobalite	14464-46-1		
Quartz	14808-60-7		
Tridymite	15468-32-3		
Tripoli ¹⁷	1317-95-9		
Shale oils ¹³	68308-34-9		
Soots, tars, and mineral oils	8007-45-2		
Strontium chromate	7789-06-2		
Sulfuric acid ¹⁸	7664—93-9		
Tars ⁸	8007-45-2		
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1746-01-6		
Thorium dioxide	1314-20-1		
ortho-Tolidine (3,3'-Dimethylbenzidine)	119-93-7		.1003
Uranium (natural)	7440-61-1		
Soluble and insoluble compounds			
Vinyl bromide	593-60-2		
Vinyl chloride ¹⁹	75-01-4		.1017 ⁶
Wood dust (certain hardwoods including beech and oak and hardwood/softwood mixtures) ²⁰			